

This Appendix was prepared from Issue 30 of Drawing ES-240075

#### METHOD OF OPERATION

Panel System - Selector Circuit District For Coin Lines with Message Register if Specified for Panel Line Finder.

#### 2. WORKING LIMITS.

Working limits for trunk supervision changed to read as follows:

3415 ohms for 24V and 8000 ohms for 48V

Working limits for subscriber's supervision changed to 1500 ohms.

Change to Read:

#### 9. FINDING CALLING LINE

When the selector brushes make contact with the terminals associated with the calling line, the (H) relay operates from battery in the trip circuit. With the (H) relay operated, a 50 ohm non-inductive shunt is connected to its winding, to ground on its armature for the purpose of increasing the current through the 500 ohm winding of the (O) relay in the trip circuit, thus speeding its operation. This is necessary on account of the very short time period during which the H brush makes contact with the H terminals before the circuit over the H lead is opened by the overthrow of the selector. The (H) relay operated opens the circuit which holds the (LF) relay operated, but (LF) relay does not release immediately on account of a circuit being closed from ground on the C commutator brush and segment, to battery through both windings of the (LF) relay in series. The (LF) relay is thus held operated until the brushes are centered on the terminals of the calling line. When the circuit through the C commutator segment is opened, the (LF) relay releases and (a) opens the circuit through the UP magnet, which stops the selector brushes on the terminals of the calling line, (b) opens the circuit through the 800 ohm winding of the (F) relay so that when the circuit through its 1000 ohm winding is opened, by the release of the (CI) relay when the district sender selector seizes an idle sender, the (F) relay releases, (c) closes a circuit operating the (SL) relay.



Change to Read:

12. COMPLETING FUNDAMENTAL CIRCUIT

With the switch in position 2, the tip and ring leads are closed from the calling line to the tip and ring leads of the associated sender circuit, thus permitting the dialing tone to be transmitted back over the dialing circuit from the associated sender, as an indication that the apparatus is ready to receive the call by the operation of the station dial. The tip side of the dialing circuit is closed from the tip of the line, through the break contact of the (F) relay, cam P, to the tip brush of the sender selector. The ring side of the dialing circuit is closed from the ring lead of the line, through the break contact of the (F) relay, winding of the (DC) relay, cam Q to the R brush of the sender selector. In position 2, the (CI) relay operates through the outer winding to ground on cam S and remains operated until the switch advances from position 10. The (CI) relay operated, (a) connects ground through the inner contacts of cam S, to the test brush of the sender selectors, thus making the associated sender test busy after the switch advances to position 2, (b) closes the tip side of the fundamental circuit through to the sender, (c) operates the (CI-I) relay which closes the sender control SC lead through cam V, cam U, to battery through the outer winding of the (D) relay. After the sender functions, the fundamental circuit is established for the operation of the district (L) relay and the stepping relay in the sender over the "FT" lead. The (L) relay operated, locks through its 1200 ohm winding and make contact through cam L over the "FT" lead and advances the switch to position 3 from ground on cam M. The 600 ohm winding of the (CH) relay is also connected through cam U, in parallel with the winding of the (D) relay. Should the (CH) relay operate at this time due to a high resistance ground in the sender circuit, no useful function will be performed.

ENG: J.D.J.

CHK'D: J.D.J.

APP'D.  
H. C. TOWNSEND  
C.C.C.



This Appendix was Prepared from Issue 29 of Drawing ES-240075.

METHOD OF OPERATION

Panel System - Selector Circuit - District for Coin Lines with Message  
Register if Specified - For Panel Line Finders

Add paragraph 3.7 which read:

- 3.7 Operates selector time alarm, or advances the district and frees the called subscriber's line, in case of failure of the calling subscriber to hang up after the called subscriber has disconnected, depending on optional wiring furnished.

In paragraph 11 change . . . "make contact of the CH relay to battery through the selector time alarm circuit not shown, which performs no useful function at this time": to read, . . . "make contact of the CH relay to battery through the selector time alarm circuit or the district release circuit. The time alarm is operated, either directly, or thru the district release circuit, if the district fails to move out of position 1."

Change paragraph 29 to read:

29. DELAYED DISCONNECT

When "N" wiring is furnished, should the calling subscriber fail to replace the receiver on the switchhook, after the called subscriber has disconnected, the release of the (CS) relay, due to the incoming trunk functioning, operates the selector time alarm circuit from ground through cam I, thereby notifying the switchman of the existing conditions.

When "V" or "Y" wiring is furnished, if the calling subscriber fails to disconnect, ground from the back contact of the (CS) relay causes the district release circuit to function and connect this ground to lead 2, operating the (F) relay which releases the (DC) and (D) relays, causing the district to restore to normal, in the case of "V" wiring for dial tone first lines, or operating the (L) relay and causing the district to advance to overflow position 15 and give the subscriber overflow tone in the case of "Y" wiring for coin first lines. In this case, the selector time alarm operates in position 15, and when the subscriber hangs up, the coin is collected and the district is restored to normal as covered in paragraphs 21, 22, 24, 27 and 28.

In paragraph 37 in last sentence change . . . "as described in paragraph 23." to read, . . . "as described in paragraph 28."



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Add paragraph 39 which reads:

39. SELECTOR GROUP REGISTER

With "Z" wiring, when the district switch passes thru position 7-1/2 with relay (SL) operated and relay (F) released, ground is connected to the selector group register, which operates and registers the number of calls handled by the group of districts. The register is not operated for calls abandoned before position 7-1/2 is reached - that is, with relay (SL) released, or relay (F) operated in position 7-1/2. Without "Z" wiring, the register operates from a direct ground in position 16-1/2, thereby registering each time the district switch is rotated regardless of when disconnection occurs.

ENG.  
G.R.K.  
11-16-37  
B.A.S.

CHK'D.

G.R.K.

APP'D.

C. A. WELSHEIMER  
S.C.E.



This Method of Operation was Prepared from Issue 27 of Drawing ES-240075.

#### METHOD OF OPERATION

Panel System - Selector Circuit - District - For Coin Lines with Message Register - If Specified - For Panel Line Finder.

#### DEVELOPMENT

##### 1. PURPOSE OF CIRCUIT

This circuit is arranged to find the calling subscriber's line and connect it with the various switching apparatus necessary to complete a call.

##### 2. WORKING LIMITS

- 2.1 B-1 relay (DC) maximum subscriber's loops 750 and 900 ohms with minimum leak of 10,000 ohms.
- 2.2 206-L relay (CS) maximum external circuit loop 3025, 3910 and 5010 ohms for 24 volt battery or 7350, 9200 and 11470 ohms for 48 volt battery.

#### OPERATION

##### 3. PRINCIPAL FUNCTIONS

This circuit is used to find the calling subscriber's line and connect it with the various switching apparatus necessary to complete a call. Its principal functions are as follows:

- 3.1 To find the proper line and start the sender selector hunting for an idle sender.
- 3.2 To establish talking connections.
- 3.3 To supply talking battery to the calling station.
- 3.4 To select an idle sender.
- 3.5 To connect battery for the operation of the message register in the line circuit on a charged call.
- 3.6 Connects a busy tone to the calling station, if required.

##### 4. CONNECTING CIRCUITS

This district selector circuit will function with:



4.1. Any standard start, sender or incoming circuit.

DESCRIPTION OF OPERATION

5. INITIAL OPERATION

X LF  
X CI  
When the receiver at the calling station is removed from the switch-hook, various relays in the line circuit operate and connect battery to the H terminal of the line at the line finder multiple bank. When ground is connected to the ST lead the LF relay operates and (a) locks on its windings in series to ground on the make contact of the H relay, (b) closes a circuit over lead Y operating the GA relay in the starting circuit (c) operates the UP magnet causing the line finder selector to travel upward and hunt for terminals of the calling line, to which battery is connected, as hereinafter described, (d) closes a circuit operating the CI relay.

6. FINDING A SENDER

As the line finder selector starts upward, hunting for the calling line, a circuit is closed through the M commutator, slightly after the brushes of the selector move off-normal. Ground on the M commutator brush and segment, operates the line finder E relay. The E relay operated, (a) operates the MB relay, (b) closes a circuit operating the D relay, (c) opens the operating circuit of the CI relay, thus permitting the relay to release if the test brush of the sender selector is making contact with the test terminal of an idle sender. If the test brush of the sender selector is making contact with the test terminal of the busy sender, the CI relay locks through its outer winding, contacts of cam S, to ground on the test brush of the sender selector. With the CI relay held operated, the operation of the line finder E relay also closes a circuit operating the F relay in the line finder circuit and the district selector (STP) magnet. This circuit is traced from battery through the 1,000 ohm winding of the F relay and through the windings and break contact of the STP magnet, make contacts of the CI and E relays to ground on cam H, thereby stepping the sender selector brushes one step on its back stroke. If the next sender circuit is idle the CI relay releases, in turn stopping the selector, but if the next terminal is busy the CI relay remains operated and the sender selector continues to step until an idle sender is found. When the CI relay releases, the test terminal of the selected sender is immediately made busy to all hunting sender selectors by ground connected to the test brush from cam H, through the make contact of the E relay and the break contact of the CI relay. This busy ground is connected until the switch advances from position 1 1/4. The operation of the F relay opens the tip and ring leads between the line finder commutator and the district circuit, and prevents the district L relay from operating and advancing the district



switch from normal, should the line finder selector connect to the terminals of the calling line before the sender selector finds an idle sender.

7. MAKING DISTRICT BUSY

The MB relay operated (a) locks to ground on lead X so that the MB relay will not release should the selector return to normal while another call is going through (b) closes a circuit to battery through the 800 ohm winding of the F relay, which operates if the relay was not previously operated, (c) connects ground on its armature to the series circuit through the MB relays of the other selectors in the same group, thus permitting the operation, over lead CH of the CA or CB relays in the starting circuit, when all line finder selectors in the group are off-normal, (d) opens the circuit over lead Y, to prevent the GA relay from reoperating, (e) transfers the ST lead to the next line finder which, if busy, transfers the call over the ST lead in the same manner until an idle line finder is found.

8. RELEASING THE TRIP AND START CIRCUITS

As the line finder selector continues upward, at the end of the tripping zone, the K brush makes contact with the K commutator, thus connecting ground to the K lead which short circuits and releases various relays in the trip and start circuits. The trip and start circuits are thus released and the circuit over the X lead is opened but the MB relay will not release as it is held operated through its operating winding.

9. FINDING CALLING LINE

When the selector brushes make contact with the terminals associated with the calling line, the H relay operates from battery in the trip circuit, over lead H, to the H multiple terminal and brush of the H commutator brush and segment, outer contacts of cam W, winding of the H relay to ground on the break contact and armature of the DS relay. With the H relay operated, a 50 ohm non-inductive shunt is connected to its winding, to ground on its armature for the purpose of increasing the current through the 500 ohm winding of the O relay in the trip circuit, thus increasing its operation. This is necessary on account of the very short time period during which the H brush makes contact with the H terminal before the circuit over the H lead is opened by the overthrow of the selector. The H relay operated opens the circuit which holds the LF relay operated, but LF relay does not release immediately on account of a circuit being closed from ground on the C commutator brush and segment, to battery through both windings of the LF relay in series. The LF relay is thus held operated until the brushes are centered on the terminals of the calling line. When the circuit through the C commutator



segment is opened, the LF relay releases and (a) opens the circuit through the UP magnet, which stops the selector brushes on the terminals of the calling line, (b) opens the circuit through the 800 ohm winding of the F relay so that when the circuit through its 1000 ohm winding is opened, by the release of the CI relay when the district sender selector seizes an idle sender, the F relay releases, (C) closes a circuit operating the SL relay. This circuit is traced from ground M commutator segment break contact of the LF relay, make contact of the E relay, winding of the SL relay, cam T, make contact of D relay, to battery on the break contact of the DS relay.

#### 10. THE ADJUSTMENT OF THE "C" COMMUTATOR BRUSH

The adjustment of the "C" commutator brush, with the relation to the trip "H" multiple brush, is such that it does not break contact with the "C" commutator segment, until slightly after the holding circuit through both windings of the LF relay is opened by the operation of the H relay when the H brush makes contact with the H terminals to which battery is connected. The UP magnet, therefore remains operated and the selector continues to travel upward until the brushes are carried slightly above the center of the line terminals, allowing the locking pawl to enter the notch on the rack attached to the brush support rod. At this time, the holding circuit through both windings of the LF relay is opened at the "C" commutator, releasing the relay. The LF relay released, releases the UP magnet. The selector then drops into place, thus centering the brushes on the line terminals.

#### 11. ADVANCING SWITCH TO POSITION 2

The SL relay operated, closes a circuit which operates the district L relay and CH relay. This circuit is traced from ground on the N commutator brush and segment, through the break contact of the F relay, make contact of the SL relay, cam O, to battery through the 600 ohm winding of the CH relay. The same ground is then connected through cam O, cam R to battery through the 800 ohm winding of the district L relay. The CH relay operated, closes a circuit from ground on cam I, break contact of the CS relay, make contact of the CH relay to battery through the selector time alarm circuit not shown, which performs no useful function at this time. The L relay operated, closes a circuit advancing the district switch to position 2. This circuit is traced from battery through the R magnet, cam B, make contact of the L relay, to ground through cam M. As the switch advances from position 1, the circuit through the L and CH relays is opened, releasing the relays and disconnecting the selector time alarm circuit. In position 1-1/2 to 2, the associated sender is held busy by ground through cam H, make contact of cam C.



## 12. COMPLETING FUNDAMENTAL CIRCUIT

With the switch in position 2, the tip and ring leads are closed from the calling line to the tip and ring leads of the associated sender circuit, thus permitting the dialing tone to be transmitted back over the dialing circuit from the associated sender, as an indication that the apparatus is ready to receive the call by the operation of the station dial. The tip side of the dialing circuit is closed from the tip of the line, through the break contact of the F relay, cam P, to the tip brush of the sender selector. The ring side of the dialing circuit is closed from the ring lead of the line, through the break contact of the F relay, winding of the DC relay, cam Q to the R brush of the sender selector. In position 2, the CI relay operates through its outer winding to ground on cam S and remains operated until the switch advances from position 10. The CI relay operated, (a) connects ground through the inner contacts of cam S, to the test brush of the sender selector, thus making the associated sender test busy after the switch advances to position 2, (b) closes the tip side of the fundamental circuit through to the sender, (c) closes the sender control SC lead through cam V, cam U, to battery through the outer winding of the D relay. After the sender functions, the fundamental circuit is established for the operation of the district L relay and the stepping relay in the sender. This circuit is traced from ground in the sender circuit, through the FT brush, make contact of the CI relay, cam L, to battery through the 1200 ohm winding of the L relay, which operates. The L relay operated, locks through its 1200 ohm winding and make contact through cam L, and the same ground over the FT lead and advances the switch to position 3 from ground on cam M. In position 3, ground through cam H is connected to the FR lead, thus permitting the sender to function. The 600 ohm winding of the CH relay is also connected through cam U, in parallel with the winding of the D relay. Should the CH relay operate at this time due to a high resistance ground in the sender circuit, no useful function will be performed.

## 13. DISTRICT BRUSH SELECTION

With the switch in position 3, the UP magnet is operated for brush selection over a circuit traced from battery through the winding of the magnet, cam C, make contact of the L relay, to ground through cam M. As the selector moves upward in position 3, carrying the commutator brushes over the commutator segments, the A segment and brush intermittently connects ground to the tip side of the fundamental circuit through cams K and L, holding the L relay operated, but successively short-circuiting the stepping relay in the associated sender circuit, thus releasing and permitting its reoperation until the proper brush has been selected. When sufficient impulses have been sent back to satisfy the sender, the fundamental circuit is opened, releasing the L relay. The L relay released, opens the circuit through the UP



magnet, thereby stopping the upward movement of the selector and advances the switch to position 4. This circuit is traced from ground through cam M, break contact of the L relay, cam B, to battery through the R magnet. When two digit senders are used with this circuit, the advance of the sender replaces the high resistance on the SC lead with a 500 ohm ground, thus insuring the operation of the CH relay. In position 4, the trip magnet (TM) is operated from ground through cam S, and the L relay is operated and locked to ground on the fundamental circuit previously described, advancing the switch to position 5.

14. DISTRICT GROUP SELECTION

With the switch in position 5, the UP magnet is reoperated and the trip magnet being operated, causes the previously selected set of brushes to trip when the selector starts upward. As the selector moves upward for group selection, carrying the brushes over the commutator segments, the B segment and brush intermittently connects ground to the tip side of the fundamental circuit through cam L holding the district L relay operated, but successively short-circuiting the stepping relay in the associated sender circuit, thus releasing and permitting its operation until the proper group has been selected. When sufficient impulses have been sent back to satisfy the sender, the fundamental circuit is opened, releasing the L relay which in turn opens the circuit through the UP magnet and advances the switch to position 6. When three digit senders are used with this circuit, the advance of the sender replaces the high resistance ground on the SC lead with a 500 ohm ground, thus insuring the operation of the CH relay. With the switch in position 6, a circuit is closed from ground on the line finder N commutator, brush and segment, through the break contact of the F relay, make contact of the SL relay, inner contacts of cam O, cam R, to battery through the 800 ohm winding of the L relay, operating the relay. The L relay operated, advances the switch to position 7.

15. TRUNK HUNTING WITH TRUNK IDLE

Should the first trunk in the group in which the selector is hunting be idle, the L relay releases as the switch leaves position 6 1/4. When the switch enters position 6 1/2 ground is connected to the sleeve of the selected trunk through cam M, break contact of the L relay, cam E, as a busy condition until the switch advances to position 7 3/4.

16. TRUNK HUNTING WITH TRUNK BUSY

Should the first trunk in the group in which the selector is hunting be busy the L relay is held operated in a circuit from battery through its inner winding and make contact, cam E to ground on the sleeve terminal of the busy trunk. With the switch in position 7, the



UP magnet is reoperated from ground, on cam M under control of the L relay and the selector travels upward until an idle trunk is found. When the idle trunk is found, the locking circuit through the inner winding of the L relay is opened but the relay does not release immediately, due to a circuit being closed from battery through its outer winding, cam R to ground through the C commutator brush and segment. When the brushes are centered on the trunk terminals, the circuit through the C commutator segment is opened and the L relay releases and opens the circuit through the UP magnet, which stops the selector brushes on the terminals of the selected trunk. The L relay released, also advances the switch to position 8.

17. "C" COMMUTATOR

The adjustment of the "C" commutator brush, with relation to the tripped sleeve multiple brush, is such, that it does not break contact with the C commutator, until slightly after the holding circuit through the inner winding of the L relay is opened, by the sleeve brush leaving the busy terminal and making contact with the sleeve terminal of the idle trunk. The UP magnet, therefore, remains operated and the selector continues to travel upward until the brushes are carried slightly above the center of the trunk terminals, allowing the locking pawl to enter the notch on the rack attached to the brush support rod. At this time, the holding circuit through the outer winding of the L relay is opened, at the "C" commutator, releasing the L relay which in turn releases the UP magnet. The selector then drops into place, thus centering the brushes on the trunk terminal. During trunk hunting, in position 7 only, the commutator feed ground is supplied from ground on cam M under control of the L relay. This is to prevent the reoperation of the L relay by the closing of a circuit between the C commutator brush and segment on the overthrow of the selector or as it drops into place.

18. SELECTION BEYOND

As the switch advances from position 7, ground on cam H is removed from the fundamental ring (FR) lead, and in position 7 3/4, ground through cam E is connected to the sleeve of the selected trunk as a busy condition. With the switch in position 8, a circuit is closed from ground on the armature and make contact of the CH relay, through cam O, cam R to battery through the outer winding of the L relay, which operates advancing the switch to position 9. In position 9, the tip and ring sides of the outgoing fundamental circuit are closed through the tip and ring terminals of the selected trunk for selection beyond, through the FT and FR brushes of the sender selector, cams F and G respectively. After selection beyond has been completed, ground in the sender is removed from the SC lead, releasing the CH relay, in turn releasing the L relay. The L relay released, advances the switch



to position 10. As the switch leaves position 9 1/2, the dialing circuit is opened at cams P and Q, in position 9 3/4, the tip and ring leads from the line finder are closed through cams P and Q respectively to 24 volts battery and ground in the district, holding the DC relay operated, under control of the station switchhook. With the DC relay operated, a locking circuit is closed for the D relay after the switch advances from position 10. This circuit is traced from battery through the inner winding of the D relay, make contact of the DC relay, make contact of the D relay to ground through cam I. The D relay is made slow in releasing so that the connection will not be lost if the switchhook at the called station is momentarily depressed. With the switch in position 10, the sender circuit functions and connects ground to the FT lead, causing the L relay to operate and lock through its inner winding over the tip of the fundamental circuit previously described. The L relay operated, advances the switch to the talking selection position until the relay is released by the operation of the sender circuit. As the switch advances, ground is intermittently connected to the tip side of the fundamental circuit, through cam E, holding the L relay operated, but successively short-circuiting and permitting the reoperation of the stepping relay in the sender circuit. When sufficient impulses have been sent back to satisfy the sender, the fundamental circuit is opened, releasing the L relay. The L relay released, opens the circuit through the R magnet, stopping the switch in position 11, 12 or 13, depending upon the class of call. As the switch leaves position 10, the holding circuit of the CI relay is transferred from ground on cam S to ground on cam E, under the control of the L relay. This circuit is traced from battery through the inner winding of the CI relay, inner contacts of cam U, make contact of the CI-1 relay, cam V, make contact of the L relay to ground through cam E. The release of the L relay opens the holding circuit through the CI relay, disconnecting the sender from the district circuit.

19. CALLED PARTY ANSWERS

When the receiver at the called station is removed from the switchhook, with the switch in position 11 or 12, reversed battery and ground from the incoming circuit operates the CS relay. The CS relay operated, closes a circuit from ground on cam I, through cam N, winding of the I relay, to battery through the F contact of the (CHG) interrupter. When the interrupter contact closes, the I relay operates and locks to the same ground through its make contact. When the "B" contact of the interrupter closes, the operation of the I relay closes a circuit from ground on the interrupter contact to battery through the 600 ohm winding of the CH relay, operating the relay. The CH relay operated, locks through its 600 ohm winding, cam O, to ground on its make contact. The CHG interrupter is so connected in the circuit that the operation of the CH relay is delayed for at least two seconds after CS relay operates. This delay is to prevent the false operation of the CH relay should the CS relay operate momentarily before the called party answers due to any line disturbances.



20. OPERATOR ANSWERS

The switch advances to position 13, as described above and when the operator inserts the plug of an answering cord in the answering jack of the trunk, the CS relay operates on reverse battery and ground, over the trunk. The CS relay operated, closes a circuit from ground on cam I, through cam R, to battery through the outer winding of the L relay, which operates and advances the switch to position 14. With the switch in position 14, the repeating coil and battery are disconnected and the T and R leads are connected directly to the T and R brushes of the selector through cams P and Q, respectively. As the switch enters position 13 1/2 the L relay locks in a circuit from ground over lead S of the selected trunk, and in position 14, the locking circuit through the inner winding of the D relay is transferred from the contacts of the DC relay to the contacts of cam J. In position 14, a checking tone circuit is closed over the sleeve of the operator's trunk, cam E, make contact of the L relay, cam V, 2 m.f. condenser, cam X, the S brush and terminal at the line finder bank, to ground through the winding of the CO relay for number checking.

21. DISCONNECTION - REGULAR CALLS

When the receiver at the calling station is replaced on the switch-hook, the DC relay releases, in turn releasing the D relay. The D relay released, closes a circuit through the R magnet, advancing the switch to position 16.

22. SELECTING ANOTHER SENDER

On Message Register and Coin District circuits, the CI relay operates while the switch is passing through positions 14 3/4 to 15 1/2 and another sender is selected in a manner similar to that described in paragraph 6 except that the CI relay operates in a circuit from battery through its inner winding, make contact of the E relay to ground on cam I. The ground to hold the Test terminal of the sender busy after the release of the CI relay is connected through cam H until the switch advances from position 16 1/2 and through cams C, M and I and relays L and D until the switch advances from position 17. If the call has been completed the CH relay will have operated in position 11 or 12, and as the switch enters position 16 a circuit is closed to the Selector Time Alarm Circuit, thus giving a visual and audible alarm if a sender is not selected in a reasonable length of time. With the switch in position 16, the D relay operates and when the CI relay releases, the L relay operates and advances the switch to position 17.



23. MESSAGE REGISTERING

With the switch in position 17, a circuit is closed from battery through the make contact of the SL relay, cam T, (C) resistance, make contact of the CH relay, H brush and terminal over lead H to ground through the message register, operating the message register.

24. COLLECTING THE COIN

With another sender selected as described in paragraph 22 and with the switch in position 17, the CI relay operates in the same manner as previously described. The CI relay operated, operates the CI-1 relay. When the switch stopped in position 11 or 12 for talking, the CS relay operated when the receiver was removed from the switchhook at the called station and in turn closed a circuit operating the CH relay. The CH relay operated, locks and remains locked until the switch leaves position 17 1/4. With the CH relay operated and the switch in position 17, ground is connected to the FR lead, causing the sender to function and connect the coin collect battery to the T and R leads of the sender circuit, inner contacts of cams P and Q over the T and R leads to the subscriber's station, collecting the coin.

25. RETURNING THE COIN ON UNCOMPLETED CALLS

If the receiver was not removed from the switchhook at the called station, the CH relay does not operate, therefore ground is not connected to the FR lead of the sender, but the sender functions and connects "coin return" battery over the T and R leads of the sender, to the subscriber's station, returning the coin. With the switch in position 17, the D relay releases differentially due to a circuit being closed from battery through its outer winding, upper outer and lower inner contacts of cam U, make contact of the CI-1 relay, lower contacts of cam V, to ground in the sender circuit over the SC lead.

26. RETURNING THE COIN ON NO CHARGE CALLS

When the switch stops in position 13 or 14 for talking selection, the CH relay does not operate, since the call is to an operator, and therefore the coin is returned in the same manner as previously described.

27. RESTORING THE DISTRICT TO NORMAL

When the coin has been returned or collected, the sender circuit advances and connects ground to SC lead causing the D relay to release. The D relay released, advances the switch to position 18. As the switch enters position 18, a circuit is closed through the DOWN magnet, from ground on the break contact of the D relay, upper contacts of cam D to battery, causing the district selector to return to normal.



28. RESTORING THE LINE FINDER SELECTOR TO NORMAL

With the switch in position 18, another circuit is closed from ground on the M commutator, outer winding of the DS relay, inner contacts of cam N, break contact of the D relay to battery on the break contact of the DS relay, operating the DS relay. The DS relay operated, locks directly to the same battery through its make contact and closes a circuit energizing the line finder selector DOWN magnet, restoring the line finder selector to normal. As the switch advances from position 17, battery is disconnected from the S lead of the line allowing the CO relay to release and as the switch advances from position 17 1/2 the SL relay releases. The CO relay released, again connects battery and ground to the tip and ring of the line through the L relay. The DS relay operated also closes a circuit operating the F relay. When the selector returns to normal, the circuit through the M commutator segment is opened, releasing the E, DS, MB, and F relays, restoring the circuit to normal. When the district selector returns to normal, a circuit is closed from ground on its Y commutator to battery through the R magnet, advancing the switch to position 1 or normal.

29. DELAYED DISCONNECT

Should the calling subscriber fail to replace the receiver on the switchhook, after the called subscriber has disconnected, the release of the CS relay, due to the incoming trunk functioning, operates the selector time alarm circuit from ground through cam I, thereby notifying the switchman of the existing conditions.

30. DISCONNECTION TALKING TO OPERATOR

When the plug of the answering cord is in the trunk jack at the incoming end, ground is connected to the sleeve of the trunk to hold the district L relay operated. If the plug of the cord is removed from the trunk jack before the receiver at the calling station is replaced on the switchhook, the line relay in the trunk circuit will operate, thereby holding the ground on the sleeve terminal of the trunk. When the receiver at the calling station is replaced on the switchhook, and the plug of the answering cord is removed from the trunk jack at the incoming end, the DC relay releases and ground is disconnected from the sleeve of the trunk, releasing the L relay, thus advancing the switch to position 15. As the switch advances from position 14 1/4, the locking circuit through the inner winding of the D relay is opened at cam J, releasing the relay. From this point on, the line finder and district selectors are restored to normal as described in paragraphs 22, 26, 27 and 28.



31. DISCONNECTION ON ABANDONED CALLS

(a) Disconnection before line finder selector finds line. Should the calling subscriber replace the receiver on the switchhook before a hunting selector finds the line, the L relay in the line circuit releases, removing battery from the H terminals at the multiple bank. The release of the L relay releases various relays in the trip circuit but the relays in the start circuit will be operated and the circuit over the ST lead will be closed thus causing the LF relay to operate and start the selector hunting. The selector will therefore travel to the top of the bank and when the H brush of the selector makes contact with the terminal of the H commutator (shown on trip circuit) at the top of the multiple bank, the H relay operates. The H relay operated, releases the LF relay, which in turn releases the F relay and opens the circuit through the UP magnet, stopping the selector. The N commutator segment is opened with the selector brushes resting on the "H" commutator terminal to prevent the district switch from advancing from normal when the F relay is released by the release of the LF relay. With the F relay released, the DS relay operates from ground on the X commutator brush and segment, through its 1000 ohm winding. The DS relay operates the DOWN magnet, restoring the selector to normal.

32. POSITIONS 2 TO 6

If the receiver at the calling station is replaced on the switchhook while the district switch is in position 2 to 6, the dialing circuit is opened at the calling station, causing the sender circuit to function and connect a direct ground, to the SC lead, causing the D relay to release on account of the increased current flowing through its outer winding. The D relay is connected differentially, but does not release when its inner winding is connected directly to ground and its outer winding connected to ground in series with sufficient resistance. The D relay released, operates the DS relay, which restores the line finder selector to normal as described in the previous paragraph. The D relay released, also opens the circuit through the SL relay which releases. The SL relay released, disconnects battery from lead S, and advances the district switch to position 6. With the district switch in position 6, a circuit is closed from ground through cam D to battery through the DOWN magnet, operating the district DOWN magnet, restoring the selector to normal. When the selector reaches normal, ground on the Y commutator brush and segment, advances the switch to normal.

33. POSITIONS 7 TO 10

Should the receiver be replaced on the switchhook while the district switch is in any of these positions, the line finder circuit is restored to normal as previously described. Trunk hunting and selection beyond will take place in the same manner and the advance of the sender circuit



advances the switch to position 10. In position 10, the release of the D relay advances the switch to position 16. From this point on the district switch is restored to normal as described in paragraphs 22, 25, 26 and 27.

34. TELL-TALE - LINE FINDER SELECTOR - BRUSHES NOT TRIPPED

34.1 R Wiring

Should the selector travel to the tell-tale position while hunting, due to the multiple brush not being tripped, the F relay remains operated through its outer winding. Ground on the commutator brush and segment is thereby connected to the lead "To tell-tale circuit", giving a visual signal to the attendant. As the N commutator segment is opened at tell-tale, the district is prevented from advancing from its normal position. The selector in this case is restored to normal, manually by the attendant.

34.2 S Wiring

With the circuit connected per "S" wiring, the LF relay releases when the line finder reaches tell-tale, due to the N and C segments being opened. The release of the LF relay releases the UP magnet, and also releases the F relay provided a sender has been found. The release of the F relay operates the DS relay which locks, operates the down drive magnet and reoperates the F relay, returning the line finder to normal.

35. TELL-TALE - LINE FINDER SELECTOR-BRUSHES TRIPPED

Should the selector travel to the tell-tale position while hunting, with the multiple brush tripped, the circuit is closed from battery in the trip circuit, terminal of the H commutator at the top of the multiple bank, H multiple brush of the line finder selector, cam W, winding of the H relay to ground on the armature of the DS relay, operating the H relay. The H relay operated, releases the LF relay, which in turn releases the F relay and UP magnet. The F relay released, opens the circuit through the tell-tale alarm, if furnished, and connects ground through the X commutator brush and segment, to battery through the 1000 ohm winding of the DS relay, which operates, in turn operating the DOWN magnet restoring the selector to normal. The receiver at the calling station being still removed from the switchhook, the relays in the line circuit are still operated and the call goes through as described under "Originating Call".



36. TELL-TALE DISTRICT SELECTOR

Should the selector travel to the tell-tale position during brush selection, ground on the X commutator, brush and segment is connected through to cam B, to battery through the R magnet, advancing the switch to position 8. Under this condition ground is disconnected from the SC lead in the sender, releasing the CH relay and the district remains in position 8 until it is restored to normal manually. If the district goes to tell-tale during group selection, ground on the X commutator advances the switch to position 8. In position 8, ground on the SC lead holds the CH relay operated which, in turn operates the L relay, advancing the switch to position 9. The CH and L relays remain operated and the district remains in position 9 until it is restored to normal manually.

37. OVERFLOW

If all the trunks in the group are busy, the district selector, while trunk hunting in position 7 will travel to the top of the group and rest on the overflow terminal. As the sleeve terminal at overflow is opened, the L relay releases, in turn advancing the switch to position 8. With the switch in position 8, the L relay operates from ground on the armature of the CH relay, advancing the switch to position 9. In position 9, a circuit is closed from ground on the Z commutator, brush and segment, through cam K, to battery through the R magnet advancing the switch to position 10. In position 10 a circuit is closed from ground on the Z commutator brush and segment through cam K, cam L to battery through the 1200 ohm winding of the L relay, operating the L relay. The L relay operated, locks through its 1200 ohm winding and make contact to the same ground through cam L, advancing the switch to position 14. As the switch advances from position 13, the L relay releases, and in position 14, it advances the switch to position 15. The release of the L relay also releases the CI relay, disconnecting the sender from the district circuit. With the switch in position 15, a circuit is closed from the miscellaneous tone circuit over lead C, to 2 M.F. condenser, cam G, winding of the repeating coil, 2 M.F. condenser, cams V and J, make contact of the D relay to ground on cam I. A tone is therefore induced in the other winding of the repeating coil, thus causing an "all trunks busy" tone to be sent back to the calling subscriber. When the receiver at the calling station is replaced on the switchhook the DC relay releases, opening the locking circuit through the D relay, which releases. From this point on, the switch is advanced to position 1 as described in paragraph 23.

38. "O" COMMUTATOR

The function of the "O" commutator segment is to maintain an idle condition on the multiple overflow terminal so that more than one



selector may stop on overflow at one time; otherwise the first selector reaching overflow will make the sleeve multiple terminals busy, thus causing the succeeding selectors to continue upward into the next group of trunks. The O commutator segment is opened, at overflow but the S bar is continuous. Both the O and S commutator brushes are permanently strapped together and are wired to the multiple sleeve brush. When the selector is at overflow, the O commutator brush is resting on an open (dead) segment and as the busy ground is fed through the O commutator bar only, this arrangement maintains a non-busy condition on the sleeve terminals. When necessary to combine two or more groups of trunks the multiple sleeve overflow terminals between the combined groups are made permanently busy by being connected to ground. As the S commutator bar is closed at overflow, the L relay is held operated, at this time, and the selector therefore hunts past the "make busy" terminals into the next group.

ENG.  
E.L.F.  
6-27-32  
B.A.S.

CHK'D. E.L.F.

APP'D. A. PENROD  
S.C.E.



